Beginners Guide To Building A Computer

A comprehensive guide for newbies

By- Sarfraz khan

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Chapter 1: Why You Should Learn Building A Computer?

You don’t even know how many ways you are tricked in the computer market. Computer dealers make a lot of money by taking advantage of newbies.

If you present yourself as a newbie, things can get worse and the shop owner or dealer can charge you way more than your budget.

This was the case with me when I built my computer for the first time. I had a very tight budget and it was my father who bought the parts and got the computer assembled from a computer shop.

I was very happy that I finally got a computer with a dedicated graphics card but to my surprise, the GPU was not able to run the games smoothly even at 720p. It was the Nvidia GT 210 which is the weakest among the weaklings.

Not only that but soon I found out that the power supply used in the computer was so garbage that I won’t be able to upgrade to a better GPU. That triggered a curiosity within me and my journey to becoming an active member of the PC master race began.

At the time of writing this book, I have already spent thousands of hours on research and I built dozens of computers myself.

Like me, everybody starts as a newbie and it can take quite a while before you get experienced in understanding the basics of building a computer, particularly the gaming computer.

In this guide, I have covered all aspects of building a computer in detail and will guide you step by step in building your first computer.

By the end of this guide-

- You will never be tricked by any dealer or technician again!
- You will be able to build your computer as well as you will be able to make money building computers for others
- You will have updated knowledge on every component that is present right now in the market.
- You don't have to pay dealers and assemblers again.

Chapter 2: Introduction to Computer Components

Without proper knowledge of computer components, you can never build a gaming computer. You may know a lot of components but there are still many things you need to know before starting your build.

Even though I am a huge hardware enthusiast and know about almost every component in the market, I still faced problems that lead to mistakes.

From the primary classes, we are learning a lot about the parts of the computer but now we will take a look at them in detail. To build a computer you only need 5 basic components. If any of these parts are missing, your computer won't work. These are: -

1. Processor/CPU
2. Motherboard
3. RAM/Memory
4. Storage Drive
5. Power supply

Even if you don't have a case or a graphics card or a DVD drive your computer will still work but if any of the above misses, your computer is incomplete. GOT MY POINT?

However, to build a “GAMING” computer, you definitely need a graphics card and optionally you may need parts like a custom CPU cooler, case fans, and such accessories.

Processor/CPU

The processor is the brain of the computer. It controls everything that operates on your system. Be it a simple paint application to a highly intensive game.

The processor is also called A CPU so, keep in mind if I use the word CPU, it literally means the Processor.

A processor controls the logical and arithmetic operations of a computer. If you do a 2+2 on a calculator, the processor executes it and produces the result. Similarly, if you listen to a song or some audio, the sound is first processed and converted into appropriate form by your CPU and then sent as output to the speakers.

Even the graphics you are seeing on your monitor, and the text you are reading are all because of your CPU as it processes the input and then sends the signal to the right component like GPU(graphics processing unit), monitor, speakers, printers, etc. and you get the right output.

So, each and every component in your pc is controlled by your processor.

A CPU is made of hundreds of small dots which varies in number as you change the generations of processors. Amd processors come with small pins instead but this is the intel one above.

A CPU runs at a specific fixed speed which is measured in Hertz that can range from a few hundred MegaHertz to a few GigaHertz.

Generally, all the latest processors come with at least 2.0GHz of speed can go up as high as 5.5+GHz. These processors are of two types:-

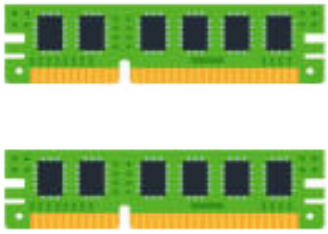
1. Locked
2. Unlocked

Locked processors are those of which you cannot increase the clock speed or you are limited to a few hundred MegaHertz.(If you own an unlocked motherboard) Unlocked processors are those of which you can increase the clock speed from a few hundred MegaHertz to a few GigaHertz.

These processors can be overclocked generally from the bios settings and by overclocking them you can get a significant amount of increase in the performance of your computer.

Generally, when I build a gaming computer I only use and recommend the unlocked processors because they are worth the money as they give some free performance in the same price.

RAM/Memory

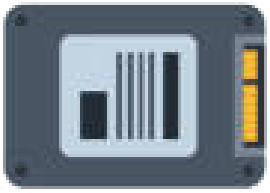


Memory or RAM(Random Access Memory) is a volatile memory that is used to store temporary data of your computer when you do some work and get erased when you switch off your computer.

So, the work of ram is generally to increase the speed of your computer by storing the important data of your programs that the CPU can access quickly instead of searching for it on the slower storage drive.

The speed of Ram is also measured in Hz and depending on the type of RAM it can feature a frequency of less than 1000MHz all the way up to 6000+MHz. Higher RAM frequency results in faster performance and the fastest RAM we currently have on the market is DDR5.

Storage Drive



Storage is referred to as an electronic device that is used for storing your data like applications, movies, games, files and folders, etc. The memory on storage drives is non-volatile and doesn’t erase the data even after the computer is switched off.

It stores data as long as you need it. If you want to delete it you can delete it any time and if you want to save it for years you can do it too. Your operating system can never work without storage or ROM(Read Only Memory). Therefore, you need to add a storage device to your system.

The HDD and SSD are the most commonly used storage devices in computers. SSD is the fastest storage you can get which is almost 10 times faster than the HDD and is used for fast OS boot and quick loading of applications.

The USB storage drive is a portable storage that can be connected to the computer externally. However, you cannot install the OS on a USB drive.

Graphics Card/GPU

Next comes the GPU which is also known as Graphics Processing Unit. Ever Wondered how the images get displayed on your screen?

This is the job of the GPU. Which collects the input from the user and then converts the signals into digital form to display on the screen. Every image is comprised of several pixels and these pixels combine to form a single image or multiple images.

These pixels cannot be seen individually by the naked eye because they are very small. Have you ever noticed why people call the resolution to be 1366x768p or 1080p or whatever?

These means pixels (Horizontal Pixels x Vertical Pixels) on your screen. The more pixels the better and clear would be the image. The more the resolution the better has to be the power of the GPU to display it properly. The same goes for your games. Your games are a lot more than just 2D images.

They are 3D advanced video effects that have to be processed in a split second and there is no simple algorithm

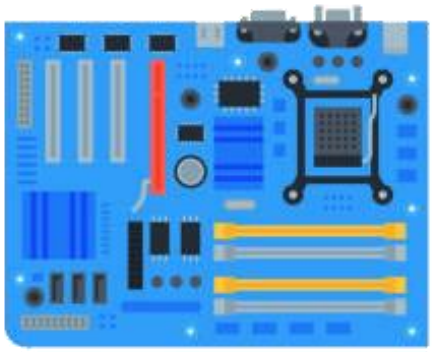
of displaying these effects. The games have detailed textures of trees, grasses, rocks, skins and detailed shadows and their respective resolutions. These all have to be resolved by the GPU.

A GPU has its own processor which does this thing. In the past, many years back a GPU was controlled by the main processor but modern GPUs have evolved themselves much that they don't need any separate processors and these are called Graphics Cards.

The speed of a GPU is also measured in frequency just like the CPU and the RAM. But a GPU has two types of clocks, one is the Processor Clock or Core Clock and one is the Memory Clock. With the increase in the processor clock, the speed of the GPU becomes faster while there is still a limit to the increase of speed of a GPU when it comes to the Memory clock.

Now, there are several more specifications of a GPU apart from the Core Clock and Memory Clock. These are the Shaders, Stream Processors/Cuda Cores, Memory Interface, Memory size, Memory bandwidth, Texture bandwidth, etc. These all contribute to the power of a GPU and the better the architecture, the faster the GPU will process and the more efficient it will be.

Motherboard



When it comes to connecting all the components, the task is only achieved by a printed circuit board which serves as a connecting interface which is called a Motherboard. The name itself suggests that this component is the mother of the computer as it connects each and every component.

The processor, graphics card, PSU, storage drive, CPU cooler, and RAM all are installed on a motherboard. Each component has a different slot on it. There are different types of motherboards and every motherboard may or may not have some slots depending upon what type of motherboard it is.

A motherboard may not have a Graphics card slot and there can be a motherboard that can have up to 4 Graphics card slots and that all depends upon the buyer's choice. Now to clear the point, you have to remember that there are four types of motherboards that we use generally in a gaming pc.

1. Mini-ITX
2. Micro-ATX

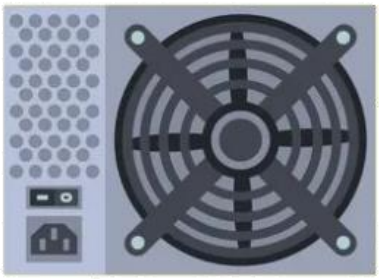
3. ATX
4. E-ATX

These are known as Form Factors. We do not use the Pico ITX and Nano ITX for gaming computers. Each of these has different sizes and comes with different features depending mostly depending on the price. The Mini ITX motherboards are the smallest in size and have very few slots and ports for components and peripherals and these are generally cheap.

The Micro ATX motherboards are a little larger in size and have more slots and ports for different components. These are the cheapest ones and are generally used for building budget gaming computers.

The ATX motherboards are high-end motherboards that have almost every port and slot for connecting any type of component or device you need whereas the EATX motherboards are enthusiast-grade high-end motherboards that have the highest number of memory and graphics card slots you can imagine with a lot more additional features.

Power Supply



Power supply is the source of power through which every component gets electrical energy in the form of appropriate voltage. Your motherboard, CPU, graphics card, ram, DVD drive, and hard drive, all need a reduced DC voltage to operate. Each of the components has its own power connecting port in it to get the power supply.

Ram consumes the least power out of all the components whereas a dedicated graphics card consumes the maximum amount of power that can go beyond 600W. For each component, you will find a dedicated power port on the component that needs to be used for supplying the voltage to that component.

A CPU is powered using an EPS connector cable that generally features 4-8 pin power connector. The CPU power port is generally situated at the top of the motherboard and the CPU gets the power after the voltage gets regulated through the VRM.

Similarly, other components like a graphics card or a storage drive also have dedicated power ports that need power from

the power supply unit. However, some components like RAM, M.2 SSDs, and Low-profile GPUs obtain power from the slots on the motherboard.

Power supplies are present in different wattage capacities and feature different power efficiency ratings. I recommend using only 80 Plus-rated PSUs that offer better efficiency and generally offer many protective features to protect your components from faulty currents and voltages.

80 Plus rated PSUs can be categorized into-

1. 80 Plus Standard
2. 80 Plus Bronze
3. 80 Plus Gold
4. 80 Plus Platinum
5. 80 Plus Titanium

High-end power supplies feature tight voltage regulation, low noise operation, higher efficiency, and low ripple noise. They generally cost more but ensure reliable operation.

Components Compatibility

Now you have known the basics of the computer components, it's time to know the compatibility of each component. Without knowing the compatibility, you will be never able to build a fully functional gaming computer.

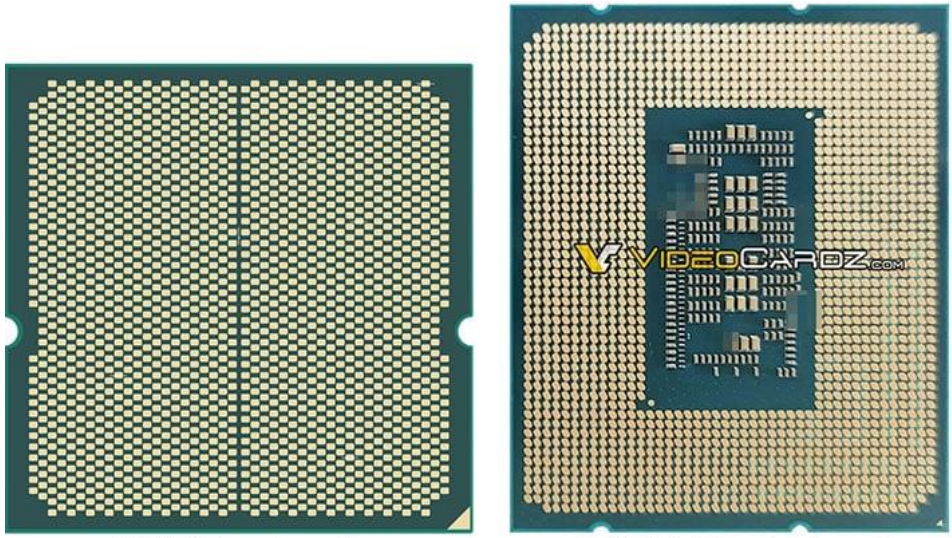
What if you buy a CPU and a motherboard without looking for compatibility and try to put the CPU into the socket? It won't work! Why?

Because there is very less chance that you have ordered a compatible motherboard and CPU. You might have bought an AMD CPU and tried to put it in an Intel Motherboard. OR You might have bought an Intel Processor and an Intel motherboard but the Socket on the motherboard is different than what the processor needs.

Therefore, you must know the compatibility before proceeding to buy the parts.

The situation will be similar for other components as well. You can not put a DDR4 RAM on to a DDR5 socket, nor you can use a 4 pin RGB device on 3 pin ARGB header.

CPU-Motherboard Compatibility



AMD Raphael
(AM5/LGA1718) 40.0x40.0mm

Intel Alder Lake-S
(SocketV/LGA1700) 37.5x45.0mm

For building a good gaming computer, it is recommended that use the latest generation processors and motherboards. For building an Intel gaming computer, it is recommended that you use a Core i3/i5/i7/i9 processor. But again, you should try to go with the latest generation.

Remember that you must use at least a four-core processor if you don’t want to face bottlenecks. Now Motherboards also come in with different chipsets. Some are for basic purposes, some are for business purposes, some are economic and some are for overclocking. But each and every motherboard with a different chipset will support every processor if the processor is made for that particular socket. Even if the motherboards have different chipsets and their prices have a large difference, still they can support the same processor.

Currently, we have Intel's 12th and 13th gen processors with Core i3, i5, i7, and i9 processors that range from 4 cores up to 24 cores. These processors use the LGA 1700 socket, unlike the 10th gen processors which used the LGA 1200 socket.

For the AMD platform, there are two types of AMD Processors that are most commonly used. We currently have the latest AM5 socket motherboard that supports Ryzen 7000 CPUs and future generation Ryzen CPUs. The AM4 platform is still alive and you can use Ryzen 1000 up to Ryzen 5000 CPUs on the AM4 socket.

Then there are Epic and Threadripper processors which are used for workstation purposes and have different sockets but for a Gaming PC or a PC for office work, AM4 and AM5 socket-compatible processors are the ones you need to know about. These are excellent in both gaming and productivity with the 7000 series being one of the top choices to buy.

RAM-Motherboard Compatibility

Next comes RAM and motherboard compatibility. After choosing a good motherboard and processor for your build, you now need to know what RAM your motherboard can support.

Currently, there are two types of RAM that are dominant in the market. These are the DDR4 and DDR5. DDR4 RAM can't be used on a DDR5 socket and vice-versa.

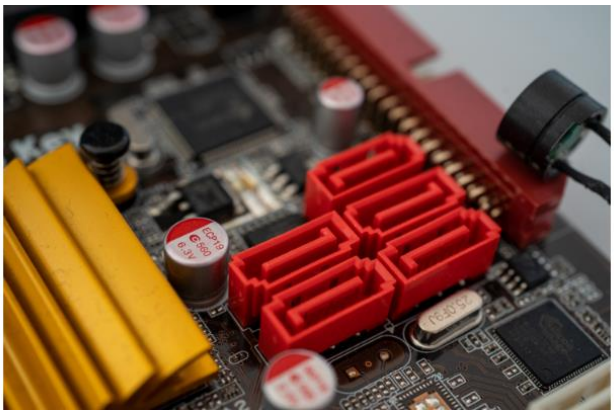
LGA 1700 socket motherboards support both types of RAM, however, the AM5 motherboards only support DDR4.

A decade ago, we had motherboards that only supported DDR1, DDR2, and DDR3 Ram but they are almost invisible in the mainstream market right now.

After choosing the correct RAM type you also need to know the maximum frequency your motherboard can support. You can find out about that on the manufacturer's site that will help you in avoiding the wrong RAM.

It should be noted that irrespective of the RAM frequency, every motherboard will support he compatible RAM on the base clock speeds but if the motherboard doesn't support higher clocks, you won't be able to run you RAM kit on the advertised frequency.

Storage Drive-Motherboard Compatibility



Storage drives are of several types but the most common ones used on desktops are the SATA and M.2. SATA interface on the motherboard lets you connect SATA drives such as 3.5” hard drives and 2.5” Solid state drives.

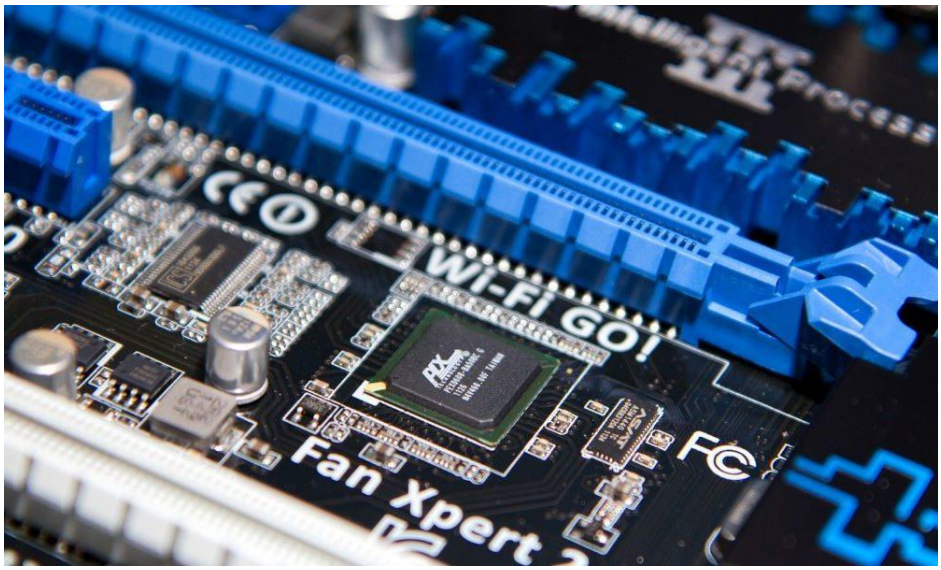
In addition to connecting them to the motherboard using a SATA cable, you also need to power them using a SATA power cable from your power supply

The M.2 SSDs use the M.2 connector on motherboards and they are more compact that SATA storage drives. They don’t need any external power connectors and are secured using a screw.

Some motherboards add restrictions in speeds or compatibility when you want to add multiple storage drives. On some motherboards, you can add up to a fixed number of storage drives after which the additional drives will get disabled or they will be limited in bandwidth.

Always check the specsheet to see the full detail.

Graphics Card-Motherboard Compatibility



Older Generation Motherboards used Graphics Processing Units that were on the CPU itself. Still, to date, almost every processor comes with an Inbuilt GPU especially Core i3, i5, and i7 CPUs from Intel and Ryzen APUs from AMD.

But if you want to install a dedicated graphics card to your motherboard, you should know what type of Slot your motherboard has and what graphics card will it support.

Older generation motherboards like the below one had an AGP slot which stands for Accelerated Graphics Port. It is a very old version slot for installing graphics cards and is currently not in use. Newer motherboards use PCI-E x16 slots for installing GPUs instead.

Managing Your Budget

You just don't go out to buy random components with different rates that don't match your budget. You have to first define your budget and your goal.

Ask yourself: -

“How Much Money I am willing to spend?”

“How should I invest money for each component?”

“Why Do I want a $500 gaming pc or a $1000 gaming pc?” etc.

Now you have a particular budget. Suppose $500, what will you do? Would you buy a $200 processor and a $50 graphics card to play games at 1080p ultra? OR Will you buy a $50 dollar processor and a $300 dollar graphics card for some small editing work or internet surfing?

Your PC will suck! Therefore, follow a particular pattern that I will show you on how to spend money on each component depending upon your goal.

Now ask the question to yourself, “What do I want?”

Is it to build a simple multitasking computer OR an awesome gaming computer? If your goal is to build a multi-tasking computer, then you should opt for a very good processor.

A 6-core CPU is the least recommended for multitasking. But if you want to build a gaming computer, you should opt for at

least a quad-core processor and a more powerful Graphics card. You can completely skip a graphics card if you only do some casual gaming like Minecraft or Counter strike but to play AAA titles, a powerful graphics card is needed.

For building a multi-tasking or productivity-oriented computer you should spend money like the following patterns: -

$300-$500 Budget

CPU	$100-$150
Motherboard	$50-$100
RAM	$50
GPU	Optional
Storage	$20-$50
PSU	$30-$50
Case	$30-$50

$600-$1000 Budget

CPU	$150-$300
Motherboard	$80-$200
RAM	$50-$75
GPU	$100-$200
Storage	$40-$75
PSU	$50-$80
Case	$50-$100

$1000-$2000 Budget

CPU	$300-$600
Motherboard	$150-$300
RAM	$75-$150
GPU	$200-$400
Storage	$60-$150
PSU	$80-$150
Case	$100-$150
CPU Cooler	$50-$150

Here is how you should manage your budget when building a Gaming PC:-

$300-$500 Budget

CPU(Better if APU)	$50-$120
Motherboard	$50-$100
RAM	$50
GPU(Optional)	$80-$150
Storage	$20-$50
PSU	$30-$50
Case	$30-$50

$600-$1000 Budget

CPU	$120-$250
Motherboard	$80-$180
RAM	$50-$75
GPU	$200-$350
Storage	$40-$75

PSU	$50-$80
Case	$50-$100

$1000-$2000 Budget

CPU	$200-$400
Motherboard	$150-$250
RAM	$75-$100
GPU	$300-$600
Storage	$60-$150
PSU	$80-$150
Case	$100-$150
CPU Cooler	$50-$150

Important Tip:- For a Gaming computer that uses a dedicated graphics card, never ignore your power supply. Buy a reliable power supply only from trusted companies like Corsair, Cooler Master, Seasonic, Evga, Thermaltake, Cooler Master, etc.

There are some more brands like NZXT and MSI that produce reliable power supplies but I recommend mostly these brands because of their trust and the services they offered for a long time.

For building a high-end gaming computer try to get a custom CPU cooler if you are planning to overclock your CPU as the stock CPU cooler will not help at all.

Choosing The Right CPU

Among all the components, you should focus on the CPU before anything else. You shouldn't make the graphics card your first priority in your system because even if you have the most powerful graphics card it will be of no benefit if you don't have a powerful enough CPU that can assign instructions quickly.

For a professional or productivity-oriented computer, you should opt for a processor that features a high core count which should be at least a 6-core or higher CPU. Intel processors are more expensive when you compare their core-to-core price but the current Raptor Lake series offers more cores than Ryzen 7000 CPUs.

If you are on a tight budget, then consider going with the AMD processors, they are also well worth the price. For under $100 you can get either a quad-core Intel processor or a Dual or quad-core AMD processor. My recommendation is to go with a quad-core AMD processor if you are building a productivity-oriented computer as it is easier to find some 6-core CPUs under $150.

Always compare the CPUs by their specs, compatibility, gaming, and application performance to choose the best one among them. There are plenty of guides out there on the internet that will show you real-world benchmarks. Take their help and decide on your own.

Choosing The Right Motherboard

After choosing your CPU, it’s time to select a compatible motherboard that offers the socket that will support your CPU. If you have chosen an Intel processor you have to buy an Intel Motherboard and the same goes for AMD CPU.

For a budget build ranging from $300 to $500, always spend under $100. You must define your needs before buying your motherboard.

Now, suppose you want to build a 300-dollar PC, you cannot go and buy a full ATX motherboard that is packed with features but costs $150-$200 otherwise you will only have 100-150 dollars left in your pocket.

Similarly, if you are building a $2000 gaming pc you shouldn't be buying a basic chipset board containing only One PCI E x 16 slot, two DIMM slots, and a few SATA ports, and no onboard troubleshooting features at all.

For building a low-budget gaming computer, get a Mini-ITX or a Micro-ATX motherboard that provides adequate slots, ports, and headers to support your components. For building a mid-end or high-end gaming computer, you should opt for an ATX motherboard that should have support for at least 4x RAM modules, 4-6x SATA ports, 1-2x M.2 connectors, 3-4x Fan headers, and a good VRM for overclocking.

Choosing The Right RAM

Your whole system's speed depends on your RAM. If you don't have enough RAM, your CPU and graphics card will suffer bottlenecks. Let’s say you want to play any latest AAA title that requires at least 8GB Ram, and you have only 4GB. Will the game run? Yes, but you will see a lot of fps drops and stutter gameplay.

Currently, the minimum recommended RAM size for most games is 8GB. If you are playing on a resolution higher than 8GB, then you would want to add another 8GB stick. Several benchmarks have shown that modern games easily use up to 8GB RAM at 1080p and you would want some extra RAM to be free for the background tasks.

Now the question is “How much RAM should you buy?” The answer is: - If your budget for the whole pc is around $200-$600, then you should use an 8GB RAM module. Currently, DDR4 is the cheapest one, so, you won’t have a problem managing your budget but if your budget for gaming build is higher than $600, consider going with 16GB of RAM.

Several tests have shown that dual-channel memory configuration works the fastest and provides a great gaming experience. After deciding the RAM size, now it’s time to select the correct RAM speed. Technically, any RAM will do the job but DDR4/DDR5 RAM speed of 3000+MHz/5200+MHz performs the best.

Choosing The Right Graphics Card

Most of your gaming performance depends on your GPU. If you buy a crappy one, you are going to lose all of your performance even if you have the best CPU, RAM, and motherboard.

Graphics card renders all the visuals and all the graphics parameters in your games and it is important that your GPU is capable of executing all the instructions assigned by your CPU quickly. If your GPU is too slow, it will bottleneck your CPU as if you have a poor GPU to start with.

I have already explained in one of the previous chapters on how you should invest in a GPU for any particular budget. This will at least help you in deciding how much you have to spend on your GPU. The next thing you have to consider is the generation of the GPU, its specs, its direct competitor from the other GPU manufacturer, and the value for the price.

Suppose you have $300 for your GPU, you should look for all the GPUs that cost around this price from all the major GPU manufacturers like AMD, Nvidia, and Intel. Make sure you only consider the latest generation GPUs because sometimes even older GPUs are available at the same price yet they are too inferior for gaming.

Now compare their performance with the benchmarks provided by third-party review sites or Youtube videos. This will be comparatively easier than choosing a CPU or RAM.

Choosing The Right Storage Drive

Storage drives have dropped in price significantly over the past year and have transitioned from traditional mechanical hard drives to blazing-fast Solid State drives.

Choosing the right storage drive is so easy these days. I recommend simply skipping a hard drive and choosing only SSDs if you want fast performance. Even though they are more expensive than hard drives, their costs have dropped significantly over the past years so much so that now most PC builders don't even consider going with hard drives.

There are two types of SSDs you can buy- SATA SSD and M.2 SSDs. SATA SSDs are connected to the motherboard via the same interface as SATA hard drives, hence, their performance is limited by the SATA port bandwidth. Still, they are at least 4-5 times faster than a hard drive. M.2 SSDs, on the other hand, if they are NVME, will be several times faster than SATA SSDs.

They don't require any cable connection and fit on a motherboard M.2 connector. They feature 3-6 times higher sequential Read/Write speeds than the SATA SSDs and help in loading the operating system and games quickly.

After choosing the type of SSD, decide how much space you want. For storing OS, some applications, and a few games, a 500GB SSD will be sufficient but you can always add more or start with a higher capacity SSD to store more data.

Choosing The Right Power Supply

Choosing the right power supply might be the most difficult task of all. There are no clear numbers like FPS when it comes to power supplies that can tell you if you should buy them. The reason for this is the little to no impact on gaming performance.

So, how do you figure out which power supply should you get?

Good power supplies come with protection features that protect your components from faulty currents and voltages. As cheap and generic power supplies can send faulty voltages to the components, there is a big risk of damaging your whole computer.

You should, hence, always check for protection features. Next, you should check the efficiency rating. Good PSUs come with at least an 80 Plus standard efficiency rating. The higher the efficiency, the better the PSU will perform. Also check for all the connectors, cables, and of course, the wattage to see if you can power your whole system and make sure you have at least 100-200W left for some little upgrades.

You can buy non-modular, semi-modular, and fully modular PSUs depending on your budget. Fully modular PSUs come with no cable pre-attached and are easier to manage. Non-modular and semi-modular are cheaper and generally get the job done for budget gaming PCs.

Choosing The Right Case

PC case is the enclosure that hosts all your components. It's the most visible PC component and sits on your desk. There are three types of PC cases in the market that are identified as form factors. These are Mini-ITX, Micro-ATX, and ATX cases. ATX cases or mid-towers are the most popular ones followed by Micro-ATX and Mini-ITX.

If your motherboard is a Micro-ATX in form factor, you have to buy at least a Micro-ATX or ATX(mid-tower) case to support it. Bigger cases are always better but not necessarily the best choice every time.

Before buying a case, you should always check the CPU cooler, GPU, and PSU clearance to see if the parts you chose will be compatible with the case. This information can be found on the official product page on the manufacturer's site. Next, you want to see how many fans and coolers can the case support.

You should also look for the routing holes. The more routing holes, the better will be the cable management. A bigger motherboard tray cut-out is also a good thing to install custom CPU coolers.

Lastly, check for ventilation. If your case is ventilated at the front, top, and rear, you are good to go. Computers can run very hot if not provided with ample airflow. Proper ventilation will ensure a balanced airflow.

Tools You Need To Build A Computer

Building a computer doesn't require a lot of tools. All you need is a #2 Philips screwdriver or equivalent to make sure you can put and tighten all the screws.

This screwdriver will be used for installing all the components. Make sure the screwdriver is magnetic or you will have a hard time finding a lost screw trapped inside your case.

Get some zip ties if possible because those will help you secure and put together all the cables together. To cut the extra part, use a nose plier or a cutter.

Lastly, make sure you stand on an uncarpeted surface when you build your computer or you may damage the circuit boards of your components through the static electricity.

Alternatively, you can use an anti-static wrist band directly connected to the metal of your case to discharge all the static from your body.

Getting Started

Building your PC requires a few small preparations in order to maintain safety. Make sure to check each and every step listed below before starting the assembly process-

1. You need a big workspace for assembling your computer.

2. Get your tools ready on the side and stand on an uncarpeted surface for preventing electrostatic discharge.

3. Unbox all the PC components and put the boxes away to have more space on your desk

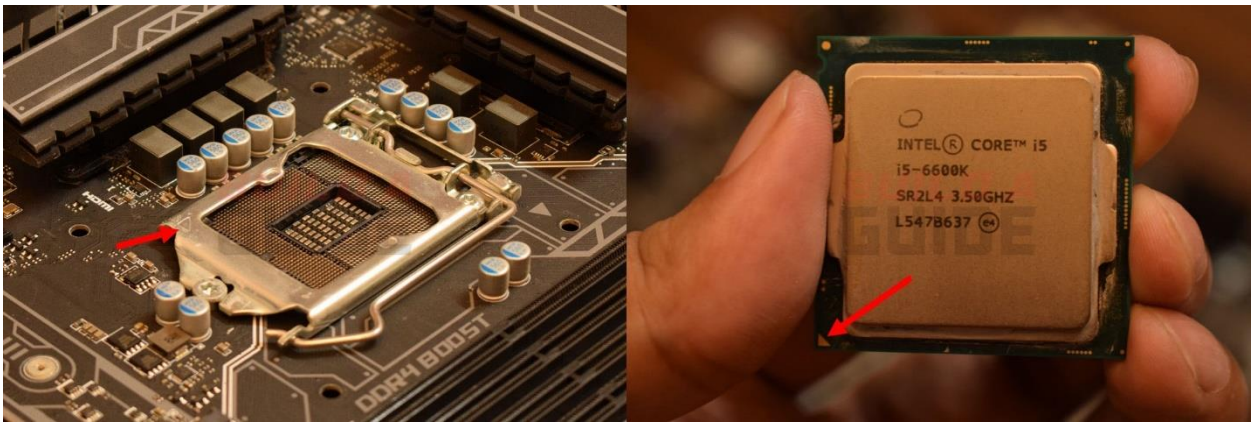
4. Use a small bowl or any box for collecting the screws, standoffs, etc. This way you won't lose them.

Here is the installation sequences we are going to use-

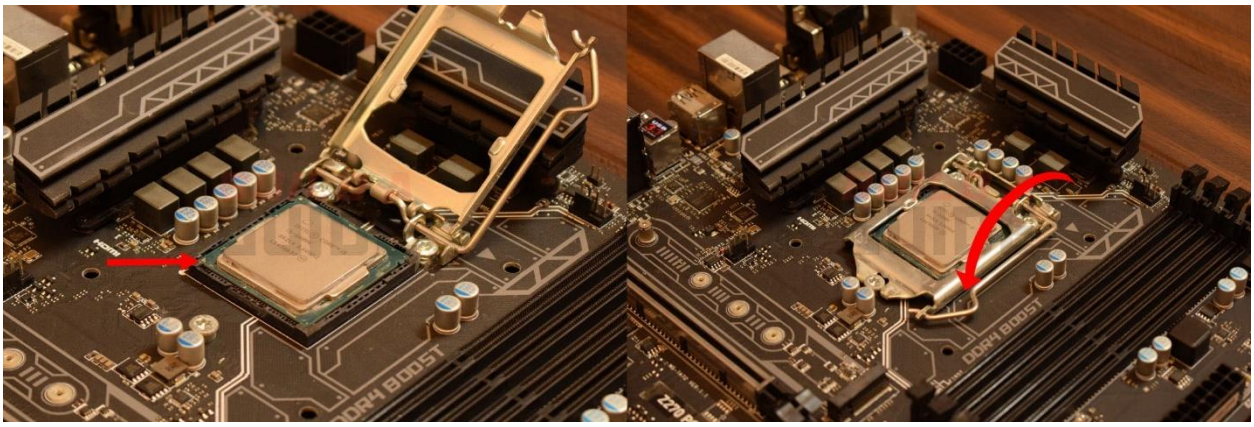
1. CPU-> RAM-> CPU cooler(Air)-> Motherboard-> Power supply-> Storage drives-> Cable connection-> Graphics Card
2. Power supply-> Motherboard-> CPU-> RAM-> CPU cooler(Air or Liquid)-> Storage drives-> Cable connection-> Graphics Card

You have to use either of these two. Personally, I would go for the second one and will guide you through it below.

Installing The CPU



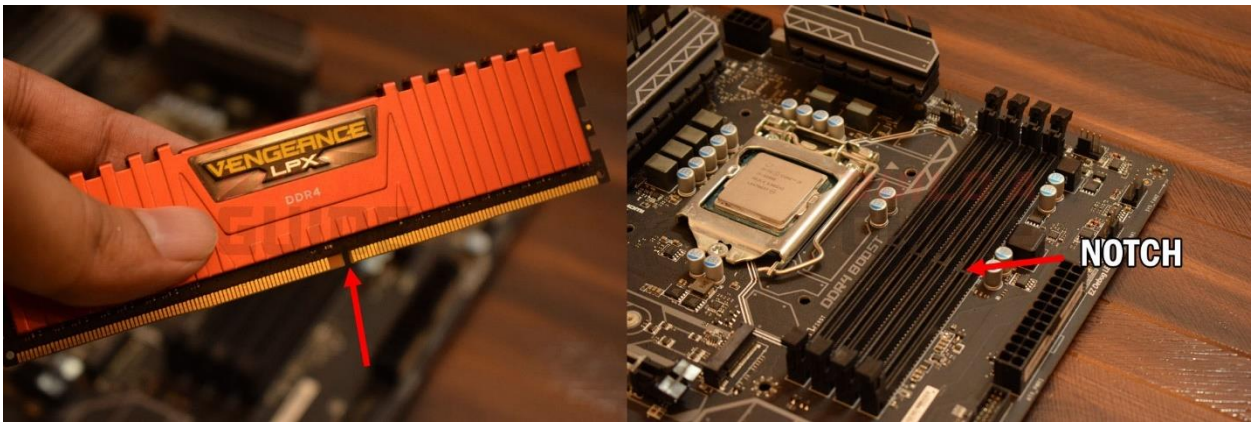
To install your processor you need to align it with the socket on your motherboard. The easiest way to do this is to identify the Arrow mark as shown in the image above. Both the socket and the CPU have this arrow symbol in one corner.



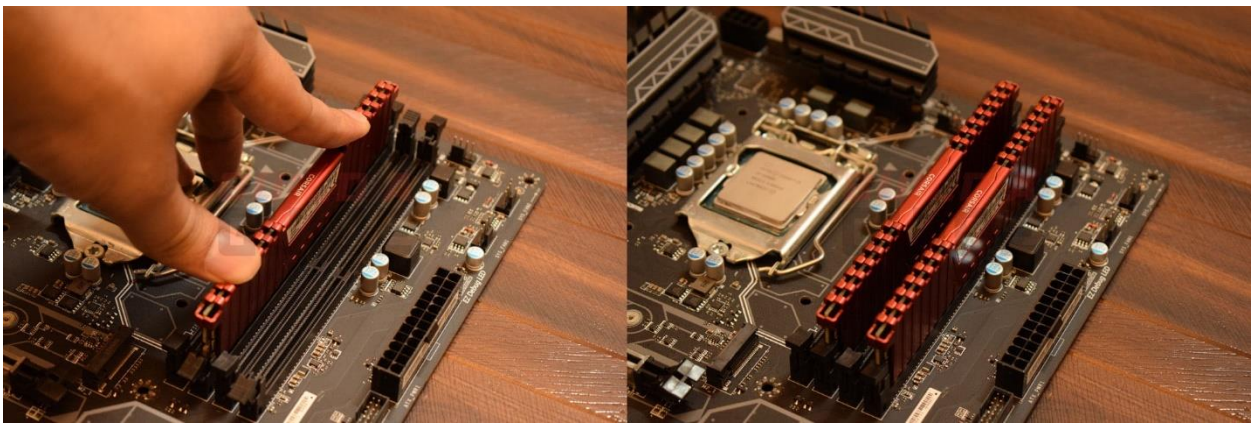
Open the socket lever and pull it to the back to expose the socket pins. Now gently put the CPU on the socket by aligning its arrow mark to the arrow mark on the socket.

Secure the processor by putting the lever back in its place. Make sure that the lower middle part of your socket cover gets under the screw present at the bottom of the socket.

Installing The RAM

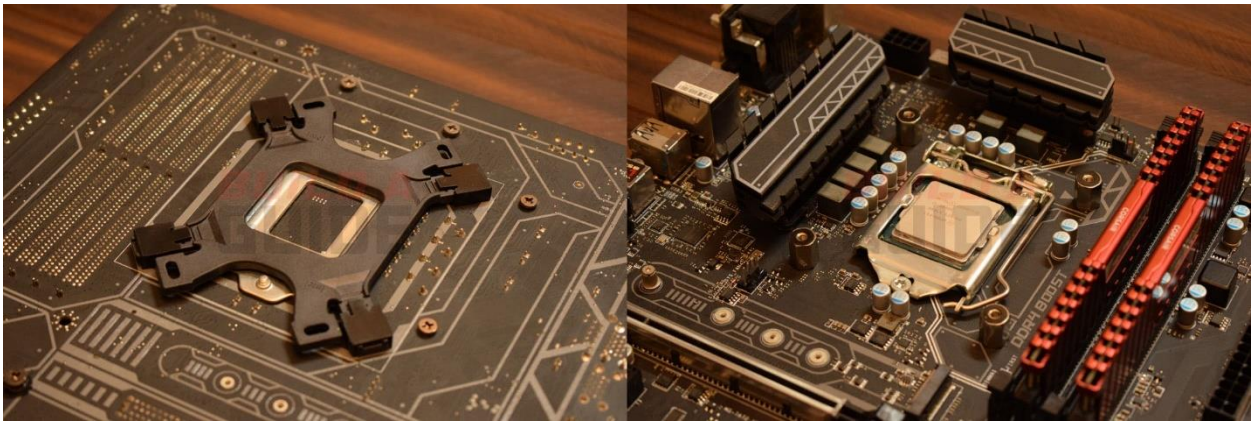


The RAM stick has a cutout in its pins somewhere around the middle. The motherboard's DIMM slots also have a plastic notch at the exact position. Before aligning the RAM module, open the plastic latches on the DIMMs from both sides to allow the RAM insertion.

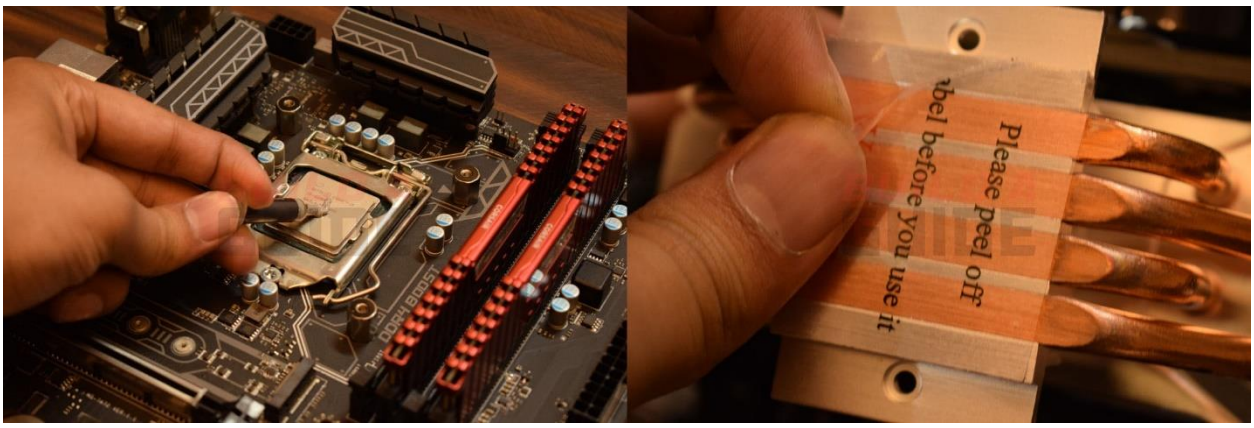


Align the RAM and use your fingers to push down the modules into the DIMM slot. Keep pushing until you hear a click sound of the DIMM latches closing from both sides.

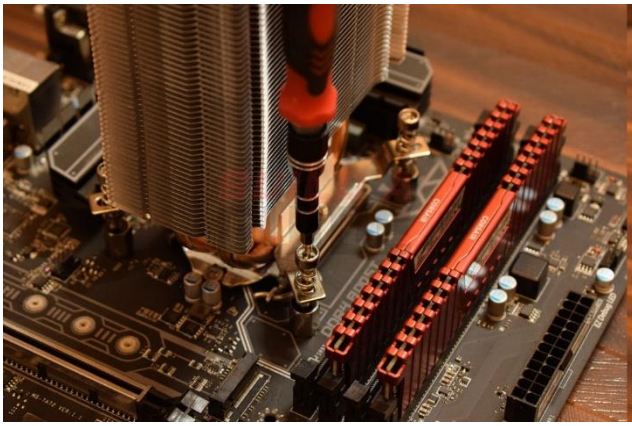
Installing The CPU Cooler



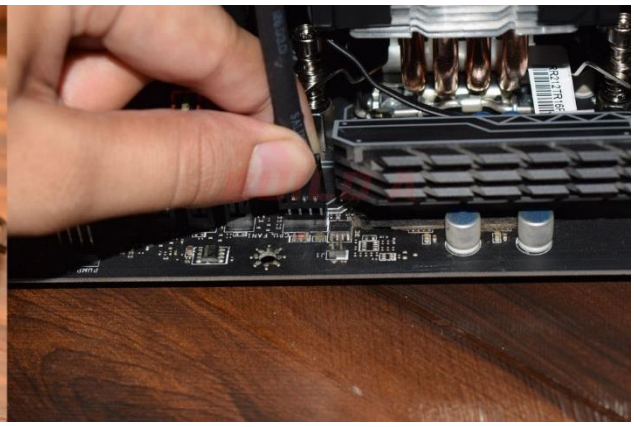
Every CPU cooler has a different way of installation and you should always refer to your CPU cooler manual. The first step is to install the cooler bracket. CPU coolers come with different parts including brackets, metal parts, screws, etc in the cooler box. Use the manual to use the correct parts.



Before installing the CPU cooler, you may need to apply some thermal paste to your processor. Some CPU coolers come with pre-applied thermal paste but if your cooler doesn't, then use the thermal paste tube or sachet that came with your cooler.




Remove the fans from the cooler before securing the heatsink on top of the CPU. Some CPU coolers won't allow you to install the heatsink without removing the fans and that is exactly because of the reasons I stated. Now tighten the screws in all four sides one by one until you get all of them tight enough to stop your CPU cooler from moving or wobbling in its place.

Attach the fan or fans on the heatsink using the plastic/metal clips provided with them. Connect the 4-pin CPU fan connector on the CPU_Fan header which is generally located at the top of the motherboard.

Installing The Power Supply

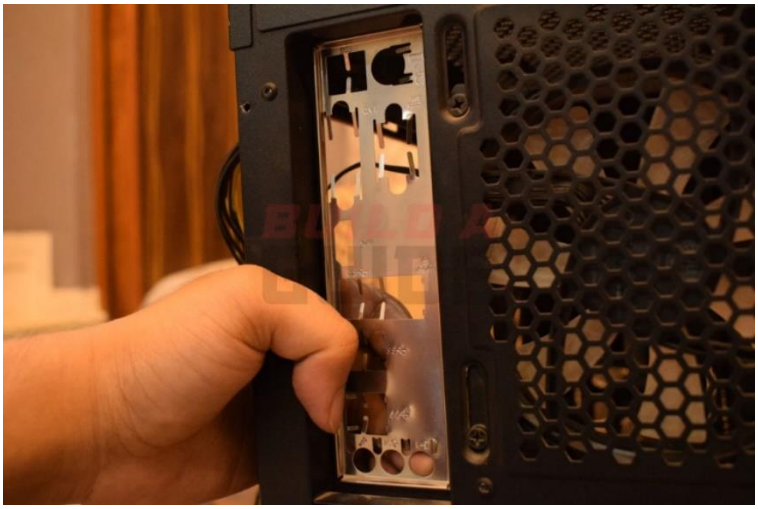
Slide the PSU into the bottom of the case. Some cases have a PSU shroud and some don't. Those which don't have a PSU shroud will require you to put the power supply from the front rather than from the rear. After its placement, secure the PSU cover with the screws to the case so the PSU won't move.

To install the PSU, you will need four #6-32 UNC screws that you will get with the PSU or the motherboard. Different cases can have different ways of installing a PSU but they will be mostly similar to each other.

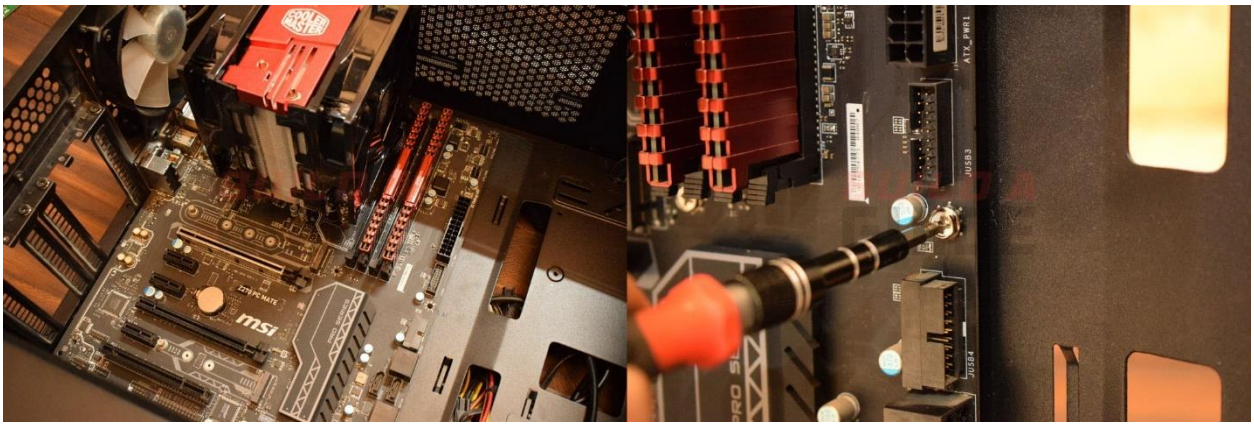
Installing The Motherboard

You will need to install the motherboard standoffs before placing the motherboard inside the case. The number of standoff screws you need to install depends on the form factor of your motherboard. A standard ATX-sized motherboard will need 9 standoffs(Standoffs come with the case).

Check the location of screw holes on your motherboard and screw the standoffs onto the motherboard tray of the case accordingly. You will need a plier or a standoff screwdriver bit M5.0.



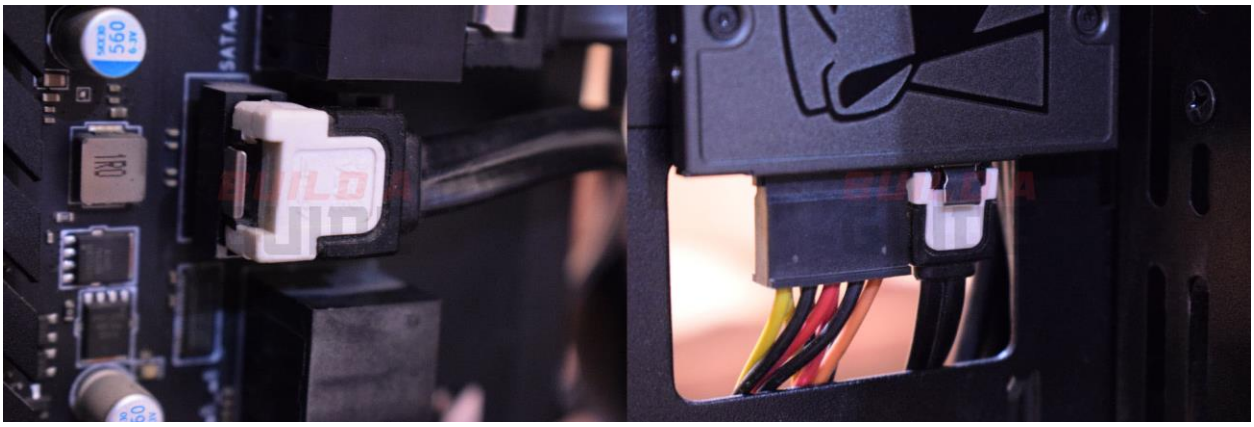
The next step is to install the I/O shield. This metal plate has holes for the motherboard I/O ports. Make sure you put enough pressure on both sides to firmly secure the shield in its place.



Place the motherboard inside the case aligning its screw holes perfectly to the standoffs inside the case while gently sliding its I/O ports inside the I/O shield. Now use the #6-32 UNC screws and mount them one by one to populate all the standoffs to firmly attach the motherboard to the case.

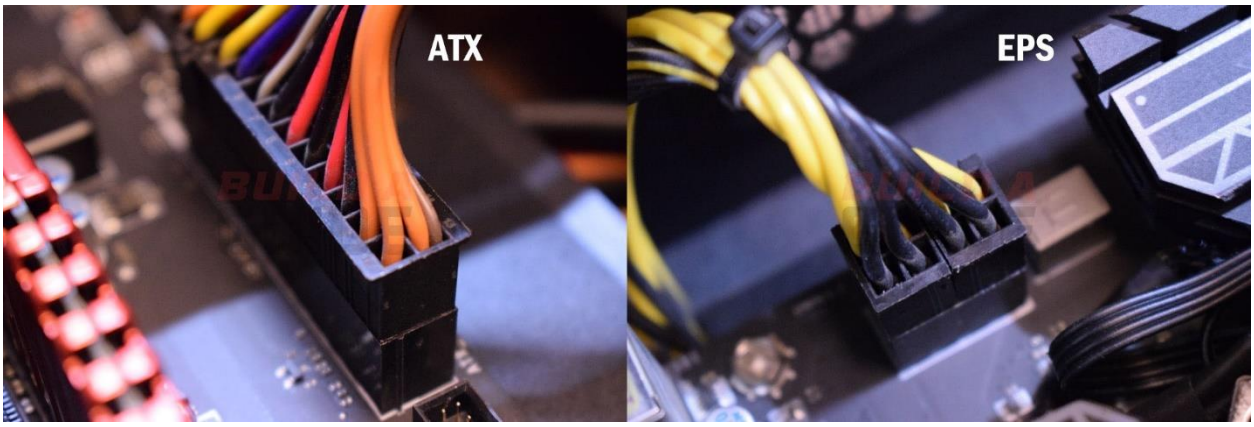
Installing The SSD

To install your SSD, remove the SSD bay from your case and put the M3 screws in all four screw holes as shown above. Now put the bay back into the case where it was attached before and tighten the thumb screw to firmly attach the SSD.



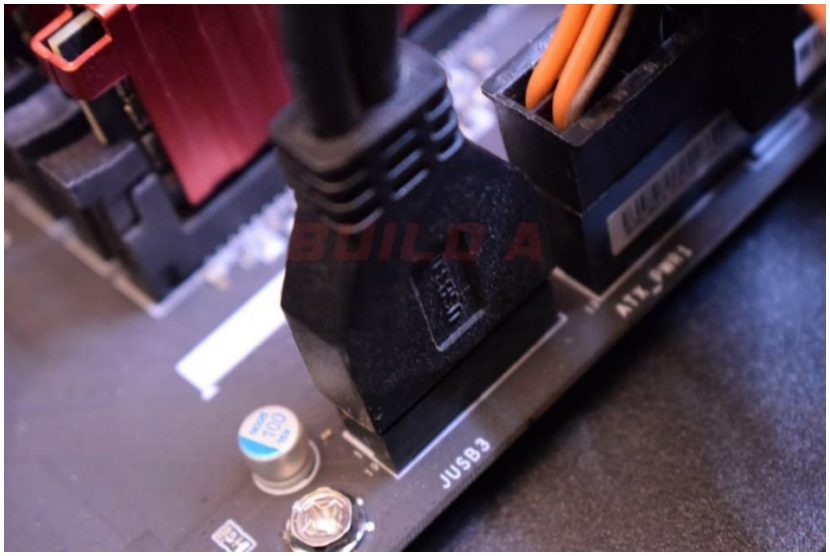
Connect one side of the SATA cable to one of the motherboard's SATA ports and the other side to the SSD. Take the 15-pin SATA power connector cable from your power supply and connect it to the power port on your SSD.

Connecting The Cables

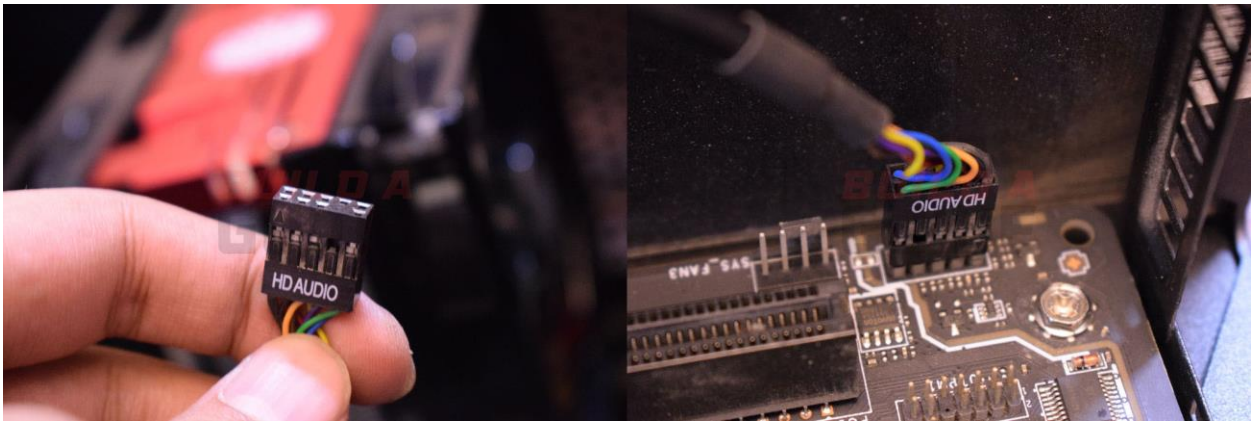


Insert the 24-pin connector into the 24-pin port situated on the right of the motherboard. It will take a good amount of pressure to fully secure the connector. Make sure it is all the way in and the clip should be holding onto the port properly.

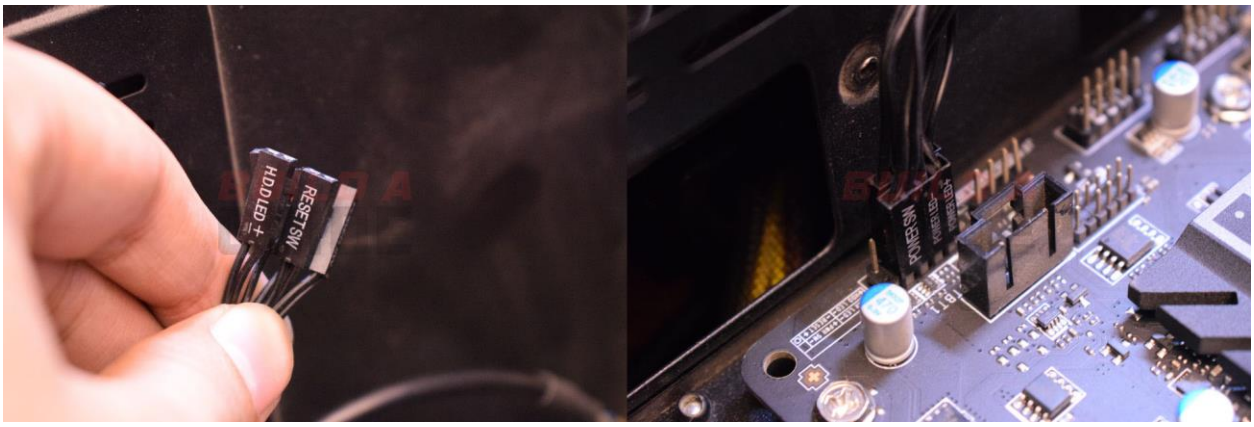
The EPS connector has a similar process. Some motherboards come with 4 or 8-pin EPS ports and are situated on the top left corner of the motherboard PCB. Simply connect the connectors aligning their plastic clips to the plastic latch of the motherboard EPS ports.



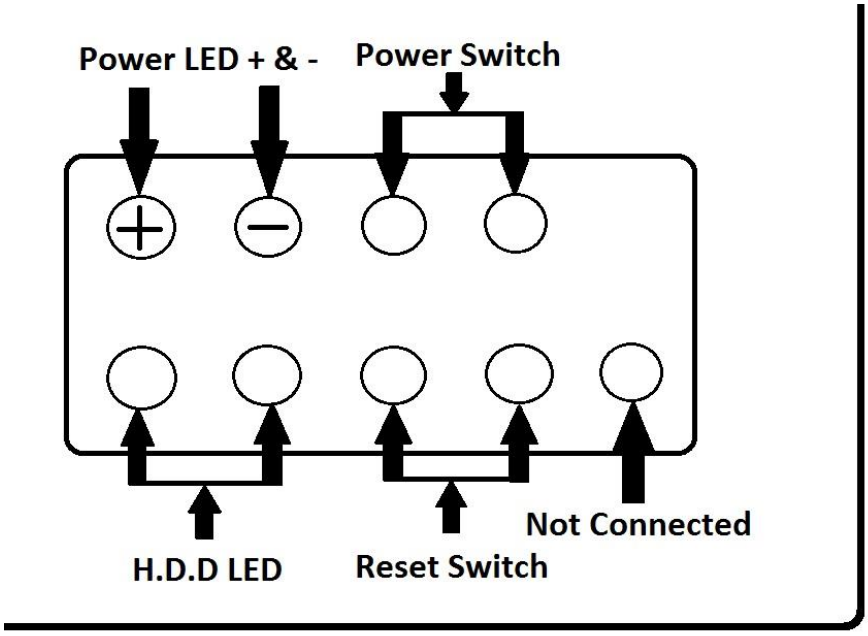
Gently align the front panel USB 3.0 connector to the USB 3.0 port on the motherboard and insert the connector into the port till it’s fully inside. There won’t be any clicking sound and the connector can be easily taken off just by pulling backward.



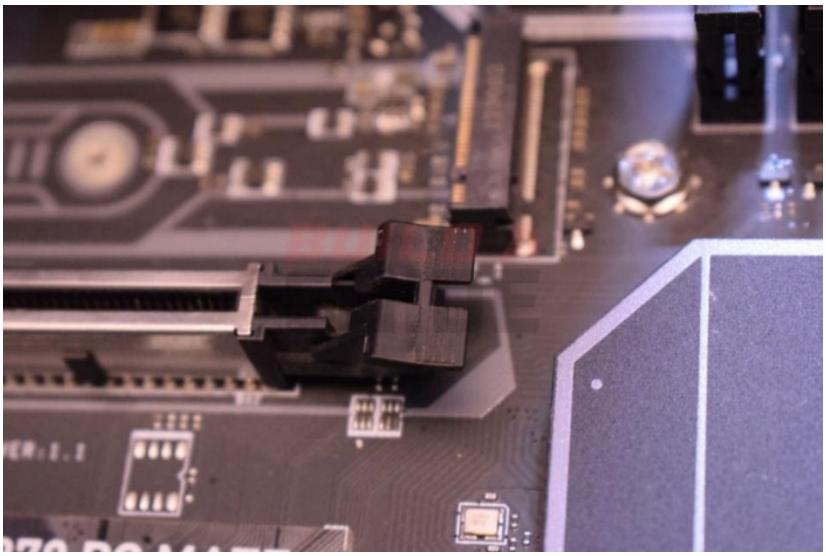
Align the 9-pin HD Audio connector to the HD Audio header on the motherboard that has the same pin sequence and inserts the connector till the pins are fully inside. Most motherboards will have an “HD Audio” label under the port that makes it easier to identify the header and it will be generally present on the bottom left corner of the motherboard.



The front panel connectors include Reset, Power, HDD LED, and Power LED connectors. There is a universal way to connect these cables as shown in the diagram below. You can start with any connector but it is better to continue from only one side. Remember that the 9th pin in the second row will be left not-connected and only the 8-pins will be populated.



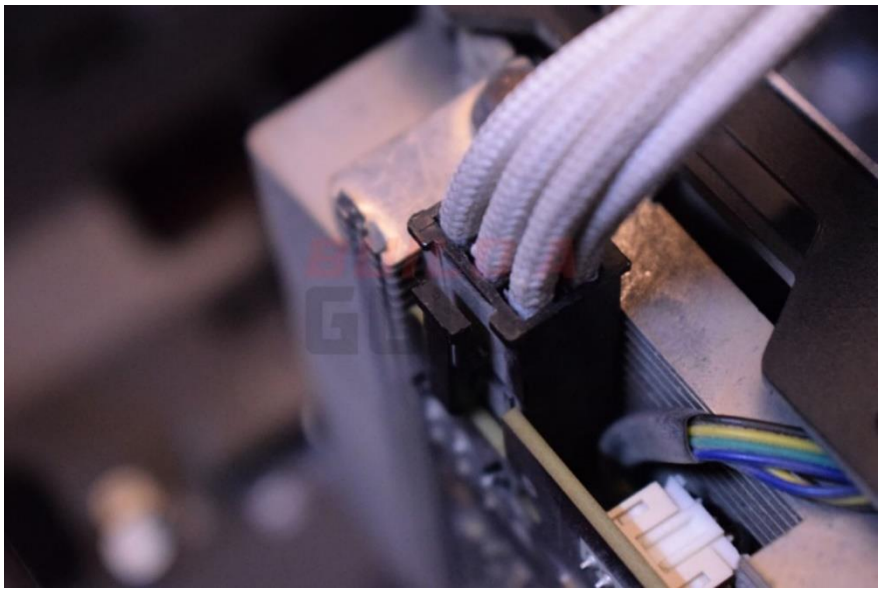
Installing The Graphics Card



Modern motherboards come with at least 1x PCI-E x16 slot and to install your graphics card, you will need to unlock the PCI-E x16 slot by pressing the plastic latch.

Before putting the GPU into the slot, remove the expansion slot cover shields from the back of the case to allow the exposure of GPU I/O. Depending upon the width of your GPU I/O area, you will need to remove 1-2 expansion slot covers.

Now align the GPU to the PCI-E x16 slot which is easier to do once you find out a cutout on the GPU pins. Apply some pressure till you hear the clicking sound of the plastic clip on the PCI-E x16 slot confirming the installation of the GPU.



Take the PCI-E connector cable from your PSU and check how the number of PCI-E ports on your GPU. Typically, it will range from 6-pin to 3x 8-pins depending on how power-hungry your GPU is. The connectors from your PSU will have a plastic clip on one side to secure the connection to the GPU ports. Simply insert the PSU cable connectors into your GPU ports till fully inside.

Finalizing

Use some zip ties after you have connected all the cables. It's recommended to use a few zip ties to secure the cables, especially the ATX one to ease putting back the back panel without any force. Make sure that you evenly spread the thicker cables and fasten them together with 1-3 zip ties

Your build is now complete and you can put back the side panel to get started with the OS installation.

Making It Work/Troubleshooting

Now is the time to test your build and the time you spent building your computer.

STEP 1: Recheck every wire and every component in your system.

STEP 2: Tighten every wire and every component again.

STEP 3: Connect the power cord and display cable to the monitor and the system.

STEP 4: Switch on your system and see whether your system starts or not. If your system starts, then check whether your monitor shows the display or not. If not, then check that the CPU fan and other components are working properly.

STEP 5: In case your system doesn't boot at all. Recheck every wire again. Sometimes we do silly mistakes and forget the basics and it is not embarrassing at all if you forget to connect the EPS or a SATA cable.

STEP 6: If your system doesn't boot or restarts every few seconds, then check if your motherboard isn't touching the metal body of the case and is properly installed on the standoff screws.

Installing The Windows

If your system boots up and the monitor shows a display signal then it will ask you for a bootable storage device containing your Operating system. You can use either a bootable USB or a DVD for OS installation. The Best operating system right now is Windows 10. I do not recommend upgrading to Windows 11 due to some technical reasons and buggy operations.

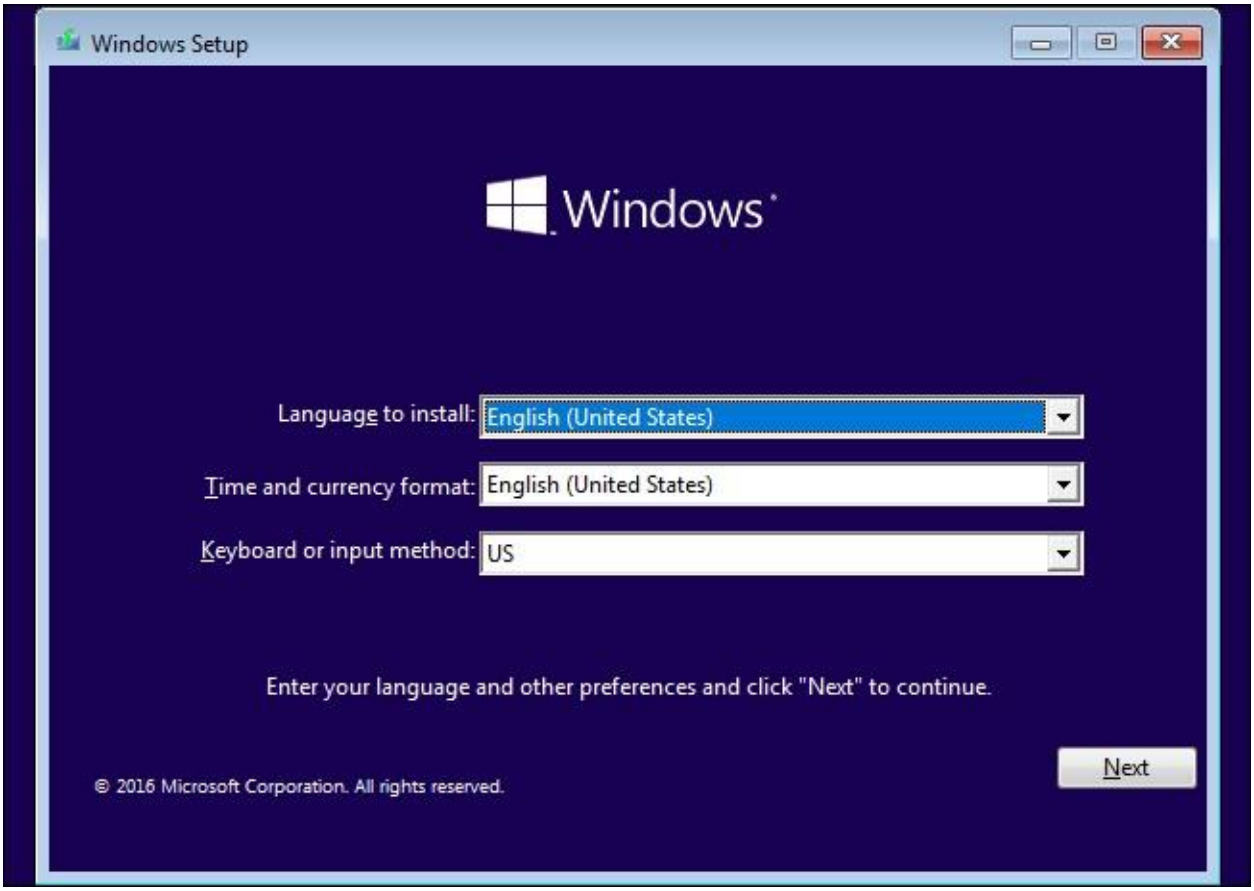
The steps for installing Windows 7, 8, and 10 are similar. So, I will take the example of Windows 10 and you can follow these steps on other Windows versions too.

You will need a USB drive to burn the ISO image of Windows 10 and you can use either Microsoft's official media creation tool or a 3rd party software like Rufus for this purpose. Windows 10 can be installed for absolutely free but you will have limited customizability.

STEP 1: Connect the bootable USB containing your Windows to the system and switch on your computer.

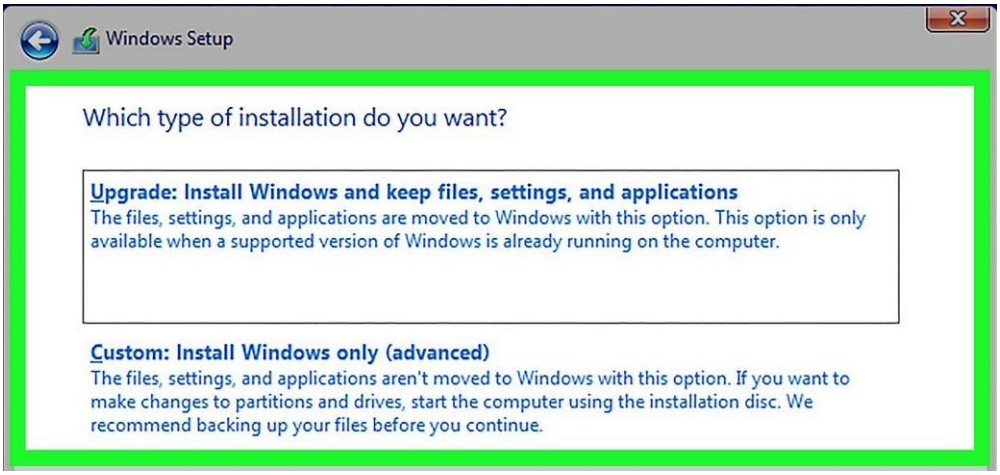
STEP 2: Your Windows installation will start automatically but if it doesn't then go to your bios settings by pressing the DEL key on system startup and change your first priority device for booting to the bootable USB drive.

The step will ask you to choose the Language, Time, and Keyboard method. Choose according to your country and click on "Next".



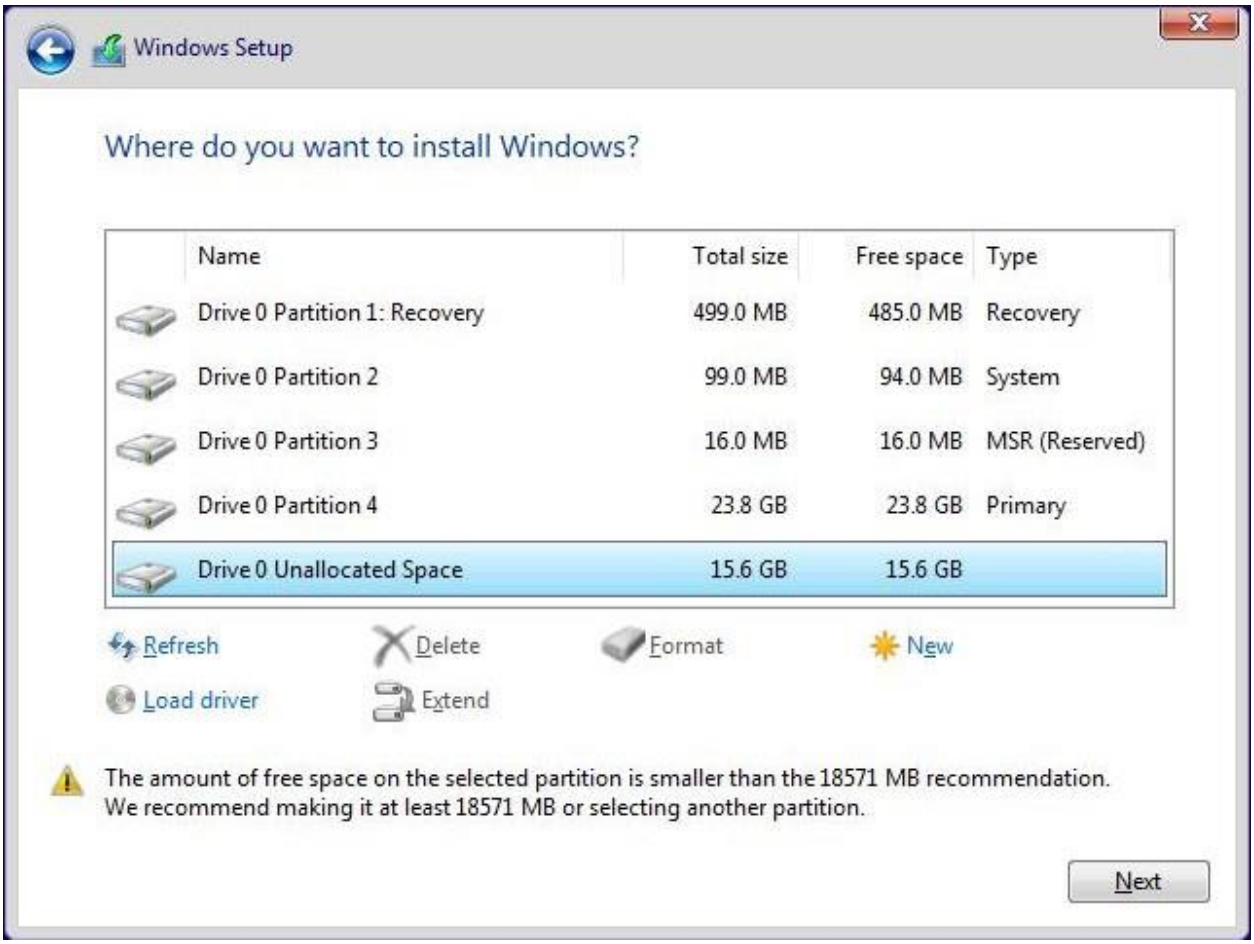
Step 3: You will be now directed towards the page where you will be asked to choose between two options:-

1. Upgrade
2. Custom



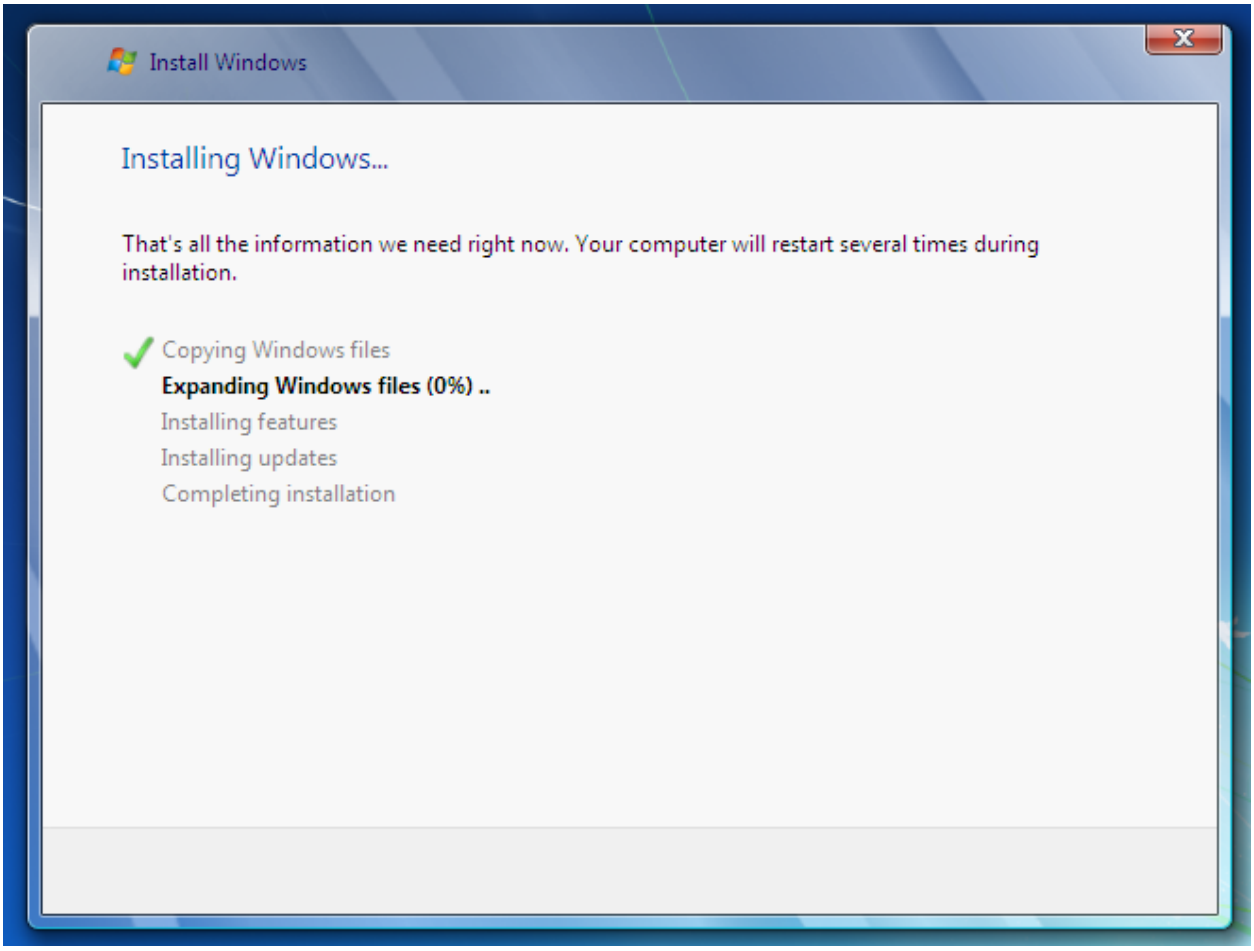
Step 4: Select “Custom: Install Windows only(advanced)” to install a fresh copy of Windows.

Step 5: Select the drive in which you want to install the Windows. Make sure you make a partition with enough space to accommodate Windows 10 and applications.



Step 6: Format the Primary drive and click on Next.

Other drives you are seeing in the image include System, Recovery, and MSR data. You cannot install Windows in those drives.



Your computer will now start the installation process which can take around 30 minutes to an hour. Your computer will start a few times but don't switch off your computer in between the process.

Follow the steps as instructed by Windows 10 inbuilt guide after it is installed and you can now customize all the settings before you start using your computer.

Installing Essential Drivers

To unlock the full potential of your computer, you will need to install a few drivers after Windows installation.

The first drivers to install are the Motherboard chipset drivers. Simply search for your motherboard model and under the “Support” tab on the site, select and install the chipset drivers that will include the LAN driver, Sound driver, and other such drivers.

Now head to your GPU manufacturer’s site and search for your GPU to download the correct driver. For Nvidia GPU users, you have to go to Geforce.com and for AMD, users will need to go to AMD.com and follow the instructions explained on the pages.

This will enable all the features of your GPU and you will have full compatibility with your games.

You can now install whatever application you like. The most recommended computer applications to install after building a computer are: Microsoft Office, 7-Zip/Winrar, Adobe Acrobat PDF reader, Adobe Photoshop, Ccleaner, VLC media player, Google Chrome, Steam, MSI Afterburner, AMD Ryzen Master/Intel XTU, and Daemon Tools.

Benchmarking Your PC

After installing the driver and software mentioned in the previous section, it's time to benchmark your computer and monitor/measure its performance.

Download software called Unigine Heaven which is one of the best CPU/GPU benchmarking software. This software will allow you to choose different graphical settings to increase or decrease the stress on your CPU/GPU.

Another Software for benchmarking your CPU is Furmark which is a very intensive GPU stress test tool. And to measure the Frames per second in games you need to install Fraps from Here.

For overclocking your graphics card you can use software called MSI Afterburner which you can download from Here. This is the best and easiest software for overclocking your graphics card safely.

There is more software for benchmarking your system but the above ones are enough for getting good results. Another great way to check your system's performance is by playing graphical-intensive games. Install Fraps to monitor FPS in real-time and tweak the settings as you like.

Final Words

Compiling this book was not easy as it took me several weeks to compile and collect all the information together. All the PC building images belong to me and are copyrighted using the “Buildapcguide” logo watermark.

I hope you are able to benefit from this ebook immensely and I wish you good luck in starting your journey as an official member of the PC Master Race.

Sarfraz (Founder)